M1/L3 Internship offer

Anomaly Detection in Internet Traffic.

Duration :	**3 months** minimum	*Place :*	Labotratoire de Physique, Ecole Normale Supérieure de Lyon, France
Requirements :	Background in Computer sciences, statistical learning; MATLAB, Python and C++		Fukuda Labs, National Institute of Informatics, Tokyo, Japan

Research team and supervision.

Patrice Abry patrice.abry@ens-lyon.fr http://perso.ens-lyon.fr/patrice.abry/

Kensuke Fukuda kensuke@nii.ac.jp http://www.fukuda-lab.org/en/research.html

Scientific context: Internet traffic monitoring.

Over the decades, Internet traffic monitoring has been an ongoing activity of major importance for designing, controlling, optimizing network resources. Notably, computer network security is of utmost importance. Anomaly detections in flows of traffic is thus an ongoing challenge. One possible approach to anomaly detection is to detect changes in the statistics of Internet traffic, notably in its temporal dynamics. Once a detection is performed, next goals are to identify the (set of) IP Address(es), that are involved in the anomaly as well as the "nature" of the anomaly.

Proposed work: Multivariate selfsimilarity and deep learning.

The French and Japanese team developed a long standing research project on Anomaly Detection. Notably, significant results were obtained using selfsimilarity (a stochastic process used to model the time series representing Internet Traffic) combined to random projections (a computer technique tool to construct self-references of "normal traffic" from which "anomalous traffic" can be defined. Such techniques remained, so far, univariate: one time series is analyzed at the time. However, Internet traffic is naturally multivariate (several links are recorded jointly, packet and bytes are recorded jointly, in-coming and out-going traffics are recorded jointly). Yet, anomaly detection based on multivariate selfsimilarity has not yet been done. Recently a new stochastic process has been proposed to model multivariate selfsimilarity. The primary goal of this internship will be to analyze anomalies that can actually be detected by applying that new tool and to compare against existing anomaly detection strategies.

Along another line, deep learning strategies are now emerging as efficient classification/detection tools. The second goal of this internship will be to investigate the issues and challenges in putting deep learning at work for anomaly detection in Internet traffic (this includes exploring how to encode into neural networks internet knowledge, such as IP Addresses or topology).

The developed tools (in matlab, python and C++) will be applied to real internet traffic made available by the Japanese team.

Location: Lyon and Tokyo.

The internship will start by a brief stay (one to two weeks) at the Physics Dept. of ENS Lyon to get introduced to the subject.

Most of the work will be conducted at the National Institute of Informatics, Tokyo, Japan.

The Internship can be subsidized by ENS Lyon, in the framework of the NII/ENSLyon MOU.

Application. All applications must be sent via email (minimum: motivation letter, CV, L3/M1 marks).

References.

http://perso.ens-lyon.fr/patrice.abry/ARTICLES_PDF/16TrafficMFRev2.pdf

http://perso.ens-lyon.fr/patrice.abry/ARTICLES_PDF/Borgnatetal09.pdf

Further details and references are available upon request.